DOCUMENT RESUME

ED 480 487 CG 032 688

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| AUTHOR | Johnson, Judy A.; Bardos, Achilles N.; Tayebi, Kandi A. |
| TITLE | Relationships between Written Expression Achievement and the Cognitive Assessment System. |
| PUB DATE | 2003-08-00 |
| NOTE | 23p.; Paper presented at the Annual Conference of the American Psychological Association (111th, Toronto, ON, Canada, August 7-10, 2003). |
| PUB TYPE | Information Analyses (070) -- Reports - Research (143) -- Speeches/Meeting Papers (150) |
| EDRS PRICE | EDRS Price MF01/PC01 Plus Postage. |
| DESCRIPTORS | *Cognitive Processes; *Junior High School Students; Junior High Schools; *Learning Disabilities; *Writing Achievement; *Writing Difficulties |
| IDENTIFIERS | *Cognitive Assessment System (Das Naglieri); *Wechsler Individual Achievement Test |

ABSTRACT

The purpose of this study was to explore the relationships between the Cognitive Assessment System (CAS) and writing achievement in junior high students (aged 11-15 years) with and without written expression disabilities. Ninety-six students with (n=48) and without (n=48) written expression disabilities were administered the Das-Naglieri: Cognitive Assessment System and the writing subtests of the Wechsler Individual Achievement Test (WIAT). Pearson correlation coefficients were computed to explore the relationship between the two measures. Significant relationships were found between the Planning and Attention composites of the CAS and the WIAT writing scales for the students with writing disabilities. In contrast, Simultaneous and Successive composites of the CAS were significantly related to writing achievement for the students without writing disabilities. (Contains 26 references and 3 tables.) (Author)

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# Relationships between Written Expression Achievement and the Cognitive Assessment System

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Abstract

The purpose of this study was to explore the relationships between the Cognitive Assessment System (CAS) and writing achievement in junior high students (aged 11-15 years) with and without written expression disabilities. Ninety-six students with (n=48) and without (n=48) written expression disabilities were administered the Das-Naglieri: Cognitive Assessment System (CAS; 1997) and the writing subtests of the Wechsler Individual Achievement Test (WIAT; 1992). Pearson correlation coefficients were computed to explore the relationships between the two measures. Significant relationships were found between the Planning and Attention composites of the CAS and the WIAT writing scales for the students with writing disabilities. In contrast, the Simultaneous and Successive composites of the CAS were significantly related to writing achievement for the students without writing disabilities.

Relationships between

Written Expression Achievement and the CAS

Writing is considered one of "humanity's highest achievements because it requires the integration of many skills" (Bradley-Johnson & Lesiak, 1989, p. 1). In the past 20 years, several models of the mental processes underlying skilled writing have been developed; the importance of planning in writing has been addressed by several of these writing theorists (Hayes, 1996; Hayes & Flower, 1986; Hayes & Nash, 1996). Few studies have addressed the relationships between writing achievement and deficient skills in cognitive processing. Unlike many intelligence tests, the Cognitive Assessment System (CAS, 1997), based on the Planning-Attention-Simultaneous-Successive (PASS) theory, includes measures of planning and attention processes.The primary purpose of this study is to examine the relationships between writing achievement and the Cognitive Assessment System in youth with and without writing disabilities.

Limited research has examined the relationship of the PASS processes and writing achievement. In addition, several of these investigations took place as part of the standardization process of the CAS. Initial findings have shown relationships between the planning scale of the CAS and writing achievement (Das, Naglieri & Kirby, 1994; Flanagan, 1992; Naglieri & Das, 1997). Research using other measures has shown deficits in higher order cognitive processes and metacognition in students with LD (Wong et al., 1996), as well as lower order cognitive processes like letter automaticity (Berninger, 1999). Further research examining the CAS and written expression is needed, especially studies which address those with writing disabilities.

The PASS theory has developed through empirical and theoretical research over the past several decades. The theory was first described as an information processing model influenced by

Luria's work (Das, Kirby, & Jarman, 1975) and then as the Information-Integration models (Das, Kirby & Jarman, 1979) and currently as the PASS theory (Naglieri & Das, 1988). The PASS theory views intelligence as four basic psychological processes; it proposes that the four essential components of human cognitive functioning are planning, attention, simultaneous, and successive processing (Naglieri & Das, 1997). Planning processes provide cognitive control, utilize knowledge, and allow self regulation to achieve desired goals, while attentional processes provide selective, focused cognitive application over a period of time (Naglieri & Das, 1997). In addition, the simultaneous and successive processes are "the two forms of operating on information" (Naglieri & Das, 1997, p. 2).

There has been limited research examining the relationship of the PASS processes and writing achievement. Ashman (1978) found that planned composition loaded highly on a factor with other planning tasks. Ashman's study was one of the earliest PASS studies to include measures of planning. This study helped form the initial hypothesis that planning skills in the PASS theory are related to writing achievement. Several years later, Flanagan (1992) found that planning tasks were the best predictor of punctuation, capitalization and written composition achievement in elementary youth referred for learning problems. Further, three studies are mentioned in the Cognitive Assessment System Interpretive Handbook that involve relationships between the CAS and writing achievement. These studies also found significant relationships between the Planning composite and writing achievement (Naglieri & Das, 1997).

The above studies, although limited in number, have shown a relation between the Planning Scale of the CAS and writing in both students with learning problems (two studies) and average achievement (three studies). Additional research is needed to test the hypothesis that students' writing achievement will be significantly related to CAS planning measures. Low

planning scores in those with writing disabilities have been observed in the limited research available using experimental and standardization editions of the CAS.

## Method

### Participants

Following the signing of appropriate parental consent and individual assent forms, 96 junior high school students (enrolled in grades 6, 7, and 8) from a school district in Southeast Texas participated in the study. Forty-eight of the students were previously identified with learning disabilities (LD), while 48 of the students were receiving instruction in the regular classroom, were not placed in special education, and served as the control group. Students were selected from school rosters on a voluntary basis and received a small incentive ($5 gift card).

Students labeled "with LD" in this study were a current junior high student (grades six, seven and eight) with identification by the school district as LD. Students met the Texas Education Agency's criteria for eligibility as a student with LD. This eligibility (method one) states that there must be more than one standard deviation between measured intelligence and achievement using norm referenced measures. The student's measured intelligence was also above the range for mental retardation (IQ above 71). In addition, students were required to score below 85 on the Written Expression subtest of the WIAT to be included in the group with LD in this study. Students were ruled out who had other special education classifications such as traumatic brain injuries, emotional disturbance, autism, hearing impairments or visual impairments. Further, the student had to have English selected as the dominant language spoken in the home.

To be included in the group "without LD," the student was required to be a junior high student who received a "B" or better in his or her language arts class. The student was also

required to score 85 or higher on the WIAT Written Expression subtest to be included in the study. In addition, the student was not receiving special education services in any disability classification and had to have English selected as the dominant language on a survey of the language spoken in the home. The students' parents complete this survey when they enroll in school.

Procedure

Informational letters and parental consent letters were sent home to the parents/guardians of eligible children. In addition, each participating adolescent signed assent forms prior to assessment. Each participant was told they could stop the testing session at any time without any consequences. Testing took place in a private testing room at each student's school during non-academic class periods.

Assessment Measures

The Standard CAS battery was administered individually, while the WIAT writing subtests were administered in small groups. The average time for testing was approximately two hours; a licensed school psychologist completed all assessments with graduate training in psychological assessment. The two measures are reviewed in more detail below:

The Wechsler Individual Achievement Test (WIAT)

The WIAT is an individually administered achievement test for ages 5-19 years that was published in 1992. The WIAT was standardized on 4,252 children who ranged in age from 5 through 19 years. The test yields 8 subtest scores in the areas of Basic Reading, Mathematics Reasoning, Numerical Operations, Spelling, Written Expression, Reading Comprehension, Listening Comprehension and Oral Expression. For the purposes of this study, only the writing subtests of Written Expression and Spelling were administered. In addition, combining the two

writing subtests as detailed in the WIAT administration and scoring manual (1992) created a writing composite. The WIAT yields standard scores with a mean of 100 and a standard deviation of 15. The two writing subtests are detailed below:

The Spelling subtest of the WIAT is designed to measure the student's ability to write letters of the alphabet that are dictated to the student, as well as the ability to encode the dictated sounds into words (WIAT Manual, 1992). The Spelling test is administered orally to the student and has a basal of five consecutive correct responses and a ceiling of six consecutive incorrect responses. The total raw score is converted to a standard score. The average reliability coefficients (age-based) of the WIAT Spelling subtest is .90 (WIAT Manual, 1992).

The WIAT Written Expression subtest requires the student to write for 15 minutes on a topic described in the writing prompt. In this study, the essays were scored using the analytic rating system described in the WIAT manual (1992). Using the analytic scoring system, the essay is rated using a one (poor) to four (excellent) scale on six element and element groups. The analytic rating system addresses the following areas: Capitalization and Punctuation; Grammar and Usage; Sentence Structure and Variety; Vocabulary; Organization, Unity and Coherence; and Ideas and Development (WIAT Manual, 1992). Average reliability coefficients (age-based) of the WIAT Written Expression subtests is .81 (WIAT Manual, 1992). In this study, three raters rated each essay and an average score for each student was recorded to increase reliability. A Writing Composite score was also computed by combining each student's score on the two writing subtests, as instructed in the WIAT administration and scoring manual (WIAT Manual, 1992).

Das-Naglieri: Cognitive Assessment System

The Cognitive Assessment System (CAS, 1997) is a measure of intellectual ability based on the PASS theory of cognitive processing. The CAS is designed for children aged 5-17 years

and the normative sample included 2,200 children. The CAS yields 4 cognitive processing scales (Planning, Attention, Simultaneous, and Successive), a Full Scale score and 12 subtest scores. The Full Scale Score and the cognitive processing scales have a mean of 100 and a standard deviation of 15. The subtest scores have a mean of 10 and a standard deviation of 3. Reliability for the CAS was determined using several methods (Naglieri & Das, 1997); subtest reliabilities (the average for all ages) ranged from .75 to .89, while the composite reliabilities ranged from .88 to .96. Since the CAS is a relatively new test, the test is reviewed in more detail below:

Planning Subtests

The CAS planning subtests include Planned Codes, Matching Numbers and Planned Connections. The CAS planning tasks require the child to create a plan, apply the plan, identify whether the plan meets the original goal, and change the plan as needed (Naglieri & Das, 1997). Each Planning subtest also has a strategy assessment checklist, which is completed on each student. The examiner marks the strategies used in completing the planning tasks. Planned Codes provides a client with codes (XX, OO, XO, OX) which correspond to specific letters, and he or she then fills in the corresponding codes in the empty boxes. This subtest is a variation of other coding subtests, which have been used to measure planning (Naglieri & Das, 1997). In Matching Numbers, the client identifies and underlines two numbers in a row that are the same. Matching numbers has been found to be related to other measures of planning in PASS research (Naglieri & Das, 1988; Naglieri, Prewett, & Bardos, 1989). Planned Connections requires the client to connect sequential stimuli that appear on a page in an apparent random manner. For example, the easier items require a child to connect a series of numbers in order, while the more difficult items has him/her connect numbers and letters alternately (A to 1, B to 2, etc.). Tasks similar to

Planned Connections have been found to correlate with other planning tests and have been used to evaluate frontal lobe functioning (Ashman & Das, 1980; Naglieri, Prewett, & Bardos, 1989).

Attention Subtests

Subtests of attention in the CAS are measures of selective attention and include Number Detection, Receptive Attention, and Expressive Attention. The Attention subtests of the CAS "require the focus of cognitive activity, detection of a particular stimulus, and inhibition of responses to irrelevant competing stimuli" (Naglieri & Das, 1997, p. 17). Number Detection has participants underline specific numbers that occur at the top of the page, while Receptive Attention has them underline pairs of pictures (younger students) or letters (older students) which are identical in appearance and then identify those with the same name. The Expressive Attention subtest varies by age, but for older participants (8-17), the client reads words, identifies colored shapes, and then must read the color of the word rather than pronouncing the word. For example, the word "blue" may be printed in red ink, and the client would say "red."

Simultaneous Processing Subtests

Measures of simultaneous processing in the CAS include Verbal Spatial Relations, Nonverbal Matrices, and Figure Memory. Simultaneous processing subtests of the CAS "require the synthesis of separate elements into an interrelated group using both verbal and nonverbal content" (Naglieri & Das, 1997, p. 21). Verbal Spatial Relations requires participants to identify the picture that correctly answers the question read by the examiner, while in Nonverbal Matrices they examine an abstract pattern and solve the item by choosing the best option to complete the matrix. Figure Memory requires the client to examine a figure (for example, a square) for 5 seconds and then identify (by tracing) the initial figure in a more complex design.

Successive Processing Subtests

The CAS Successive processing subtests include Word Series, Sentence Repetition, Sentence Questions (ages 8-17) and Speech Rate (ages 5-7). The Successive processing subtests included in the CAS were developed to deal with a serial organization of events. All the successive subtests require the individual to work cognitively with information that is presented in a specific order and for which the order is most important (Naglieri & Das, 1997). Word Series has the client repeat words in the same order as read by the examiner (from two to nine words). Sentence repetition has participants repeat each sentence (which has color words in place of nouns and verbs) exactly as it was presented, and Sentence Questions has the client answer questions about the sentence. Speech Rate involves the repeated pronunciation of words in order. For example, the time would be recorded on how long it took the client to say three words in order ten times. Speech Rate was not used in this study due to the age of the participants.

## Results

The data for this study was collected from two schools in Southeast Texas. The sample consisted of 96 participants, 56 females (58%) and 40 males (42%). The participants ranged in age from 11 years, 3 months to 15 years, 2 months. The sample included junior high students in grades six (25%), seven (49%), and eight (26%). Thirty-two of the participants were African-American (34%), 31 were Anglo (32%), 29 were Hispanic (30%), 3 were Asian (3%) and 1 was Native American (1%). All participants had English selected as their dominant language. The study included 48 students with LD (50%) and 48 students without LD (50%). The students with LD had previously been evaluated and all had been identified as LD.

Means and standard deviations are reported for both groups in Table 1. The group with LD fell in the low average range on the Planning composite, but scored in the average range on

the Attention, Simultaneous and Successive composites. The group without LD scored in the average range on all PASS composites.

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Insert Table 1 About Here

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Participants were required to score 85 or above on the Written Expression subtest to be included in the group without LD and below 85 to be included in the group with LD. The Written Expression scores ranged from 90 to 131 for the group without LD and from 60 to 84 for the group with LD. Consistent with the literature (Mather & Roberts, 1995), students with LD wrote fewer words and wrote for fewer minutes than their peers without LD. On the average, the group with LD wrote 66 fewer words and wrote for 3 minutes less than the group without LD on the Written Expression subtest. On the WIAT elements of Writing the group with LD scored lower than the group without LD on all elements.

Pearson correlation coefficients were computed on all standard scores. As expected, the CAS subtests were highly correlated with the subtests which comprise each composite; this finding was true for both the group with LD and the group without LD when correlations were ran separately. As with several other research studies with the CAS (Keith, Kranzler, & Flanagan, 2001), the Attention composite was highly correlated with the Planning composite.

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Insert Table 2 About Here

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The relationships between the CAS composites are presented in Table 2 for the group with LD and the group without LD. For the group with LD, there was a significant relationship between the Planning and the Attention composite ($r=.60$; $p < .001$), as well as the Attention and

Simultaneous composite (r=.34; p < .05). The only significant correlation for the group without LD was between the Attention and Planning composite (r=.73; p < .001).

Relationships between the CAS Composites and WIAT writing scales are presented for the group with LD and group without LD in Table 3. The group with LD had significant correlations between the Planning and Attention composites and the WIAT writing scales. The highest correlation with the Written Expression subtest was the Planning composite (r=.52; p < .001) for the group with LD. Further, the Attention composite had the highest correlation with the Spelling subtest (r=.51; p < .001) and the WIAT Writing composite (r=.56; p < .001). In contrast to the group with LD, the group without LD had significant relationships between the Successive and Simultaneous composites and the WIAT Spelling and Writing composite. No significant relationships were found between the CAS composites and the Written Expression subtest for the group without LD. However, the Successive composite had the highest correlation with the WIAT Spelling (r=43; p < .01) and Writing composite (r=42; p < .001).

A restriction of range was noted for both groups on the WIAT writing subtests. A correction for this restriction of range was then computed using the method recommended by Guilford and Fruchter (1978). These values are reported in parentheses on Table 3. After this correction, there were significant relationships between the Planning composite and Written Expression subtest (r=.63; p<.001), Spelling subtest (r=.44; p<.01), and Writing Composite (r=.59; p<.001) for the group with LD. Further, significant relationships were found between the Attention composite and the Written Expression subtest (r=.64; p<.001), Spelling subtest (r=.67; p<.001), and Writing Composite (r=.71; p<.001) for students with LD.

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Insert Table 3 About Here

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When the correction was computed for the group without LD, several significant relationships were also found between the Simultaneous and Successive composites and the WIAT writing scales. Significant relationships were found between the Simultaneous composite and the Spelling subtest ($r=.52$; $p<.001$) and the Writing composite ($r=.44$; $p<.01$) for those without LD. The Successive composite was significantly correlated with the Written Expression subtest ($r=.42$; $p<.01$), Spelling subtest ($r=.62$; $p<.001$) and Writing composite ($r=.60$; $p<.001$) for those without LD.

## Discussion

This study added to the research which addresses the PASS theory with students who have written expression disabilities. Most of the research on the PASS theory has been done with students with reading and math disabilities. The findings of this study were consistent with two other studies (Ashman, 1978; Flanagan, 1992) which found relationships between the Planning scale and written expression. However, in the above studies, an experimental set of PASS tasks were used. This research is the first study to compare the current version of the CAS in students with and without written expression disabilities. The other studies that examined the relationships between the CAS and writing took place as part of the standardization of the test. These studies, as well as the current study, found relationships between the Planning composite and writing achievement. This study contributed additional data to the research that states students who have writing disabilities have depressed scores on the Planning composite. This finding may mean difficulties in some aspects of writing may be due to poor planning processes. Additionally, the

Attention composite was significantly related to the writing achievement of students with LD; the Planning and Attention composites have been found to be significantly related.

The addition of the CAS to an assessment battery for a student with a suspected disability will yield additional information not contained in traditional IQ tests. The most commonly used IQ tests do not directly measure planning or attention processes. The CAS appeared to be sensitive to the cognitive differences of students with LD in the present study. Of course, discovering that a learning disability exists in a specific area is only the beginning. Assessment data is most useful when it can be linked to effective intervention which remediates the cognitive deficit found through testing (Das et al., 1994). An important goal of the CAS is to use the cognitive processing information to make decisions about instructional programming (Naglieri & Das, 1997). Recent research has studied how to link the CAS data to intervention planning with specific students.

A recent intervention study examined whether instruction to facilitate planning would be impacted by specific PASS cognitive profiles of the participants (Naglieri & Johnson, 2000). It was found that children with cognitive weaknesses in Planning gained the most benefit from the instruction that focused on planning facilitation. While this study was completed with students who had mathematical difficulties, the same concept could be applied to those with writing disabilities. If further studies replicate the findings in the present study, interventions to remediate planning deficits (as recognized by CAS assessment) in students with written expression disabilities may be warranted.

Several recent writing intervention studies have focused on teaching planning strategies to students. De La Paz (1997, p. 245) states, "literature now exists in which the advantages of teaching students with and without learning disabilities strategies to plan (setting process and

content goals, using text structure to generate writing content) before composing are well known." These studies have shown positive results in improving the quantity of writing, and, often the quality of the writing of students with LD. Students with LD have been shown to write fewer words and write for less time; this was found to be true for the LD group in the present study.

The relationships between the CAS subtests and composites in this study added to the research on the interrelated nature of the PASS components. However, the subtests always correlated most highly with their respective composite. This study also found a high correlation between the Planning and Attention composites and subtests; this is consistent with other recent research with the CAS (Keith, Kranzler & Flanagan, 2001; Kranzler, Keith, & Flanagan, 2000). During test development of the CAS, confirmatory and exploratory factor analyses were utilized to examine the underlying structure of the CAS (Naglieri & Das, 1997). Support for both a three-factor solution and a four-factor solution was found through factor analysis. For the most part, the factor solution hinged on whether the planning and attention scales should be separated or combined. However, the four-factor solution was chosen because it was more consistent with empirical, theoretical and clinical information (Naglieri, 1999). The works of Luria (1966, 1980) described described the close functional and structural relationship between the processes of attention and planning.

The Cognitive Assessment System shows promise as an assessment instrument that will identify cognitive processing strengths and weaknesses, and may lead to the development of programs to remediate cognitive processing deficits which result in poor academic achievement. Preliminary results of PASS intervention programs have been encouraging. Although additional research is needed, results of this study support the use of the PASS theory of cognitive

processing, operationalized in the CAS, to evaluate students who have written expression disabilities.

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**Table 1**

**Means and Standard Deviations on the CAS Composites and WIAT for Groups With and Without LD**

| | With LD | | Without LD | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Planning Composite | 85.56 | 11.30 | 106.79 | 13.78 |
| Attention Composite | 93.23 | 9.96 | 109.50 | 14.25 |
| Simultaneous Composite | 92.88 | 10.15 | 104.50 | 10.74 |
| Successive Composite | 91.98 | 10.28 | 99.56 | 9.25 |
| Written Expression (WE) Subtest | 72.19 | 6.24 | 109.48 | 9.83 |
| Spelling Subtest | 74.13 | 9.36 | 104.35 | 11.11 |
| Writing Composite | 68.98 | 8.55 | 106.75 | 10.57 |
| WE words written | 80.90 | 49.52 | 147.35 | 42.19 |
| WE time (in seconds) | 454.33 | 234.96 | 657.10 | 124.28 |

**Table 2**

**Correlations Between CAS Composites to Each Other for the Group With LD and Without LD**

| | Planning | Attention | Simultaneous | Successive |
|---|---|---|---|---|
| **With LD** | | | | |
| Planning | | | | |
| Attention | .60*** | | | |
| Simultaneous | .26 | .34* | | |
| Successive | .27 | -.02 | .08 | |
| **Without LD** | | | | |
| Planning | | | | |
| Attention | .73*** | | | |
| Simultaneous | .13 | .17 | | |
| Successive | .24 | -.01 | -.01 | |

*p < .05; ***p < .001

**Table 3**

**Correlations Between CAS Composites and WIAT Writing Scales for the Group With LD and Without LD**

| | Planning | Attention | Simultaneous | Successive |
|---|---|---|---|---|
| **With LD** | | | | |
| Written Expression | .52*** | .48** | .09 | .19 |
| | (.63***) | (.64***) | (.13) | (.27) |
| Spelling | .35* | .51*** | .13 | .05 |
| | (.44**) | (.67***) | (.19) | (.07) |
| Writing Composite | .48** | .56*** | .13 | .09 |
| | (.59***) | (.71***) | (.19) | (.13) |
| **Without LD** | | | | |
| Written Expression | .12 | .07 | .08 | .27 |
| | (.13) | (.07) | (.11) | (.42**) |
| Spelling | .21 | .19 | .40** | .43** |
| | (.22) | (.20) | (.52***) | (.62***) |
| Writing Composite | .19 | .16 | .33* | .42** |
| | (.21) | (.17) | (.44**) | (.60***) |

Note: scores in parentheses have been corrected for restriction of range.

*p < .05; **p < .01; ***p<.001

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Title: Relationships between Written Expression Achievement and the Cognitive Assessment System

Author(s): Judy A. Johnson, Achilles N. Bardos, Kandi A. Tayebi

Corporate Source: 2003 APA Conference

Publication Date:

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